



Contrast enhanced ultrasonography in the detection of liver metastases from colorectal cancer

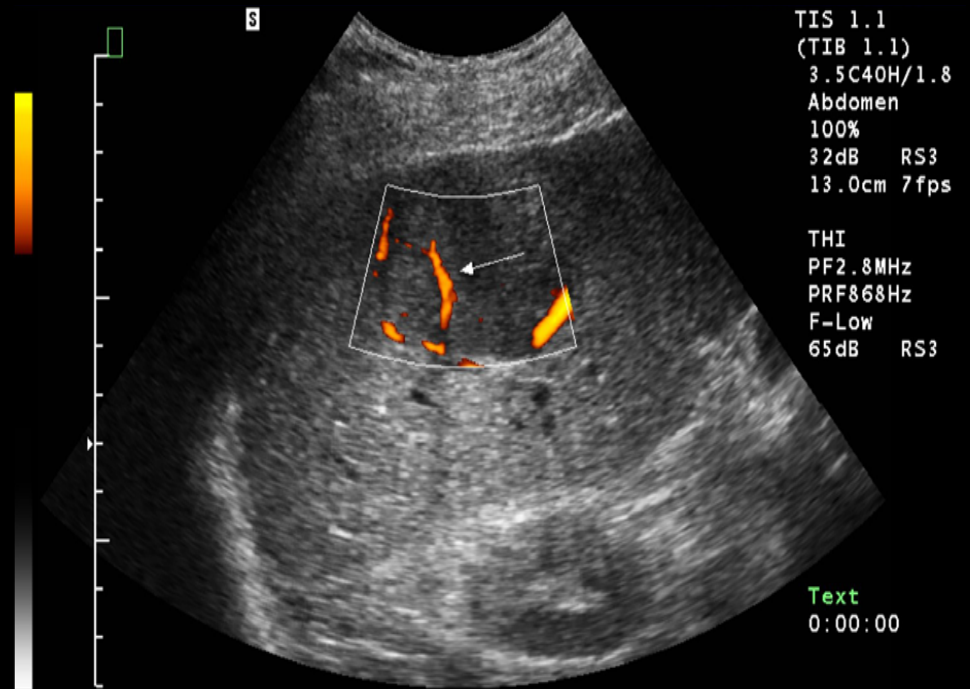
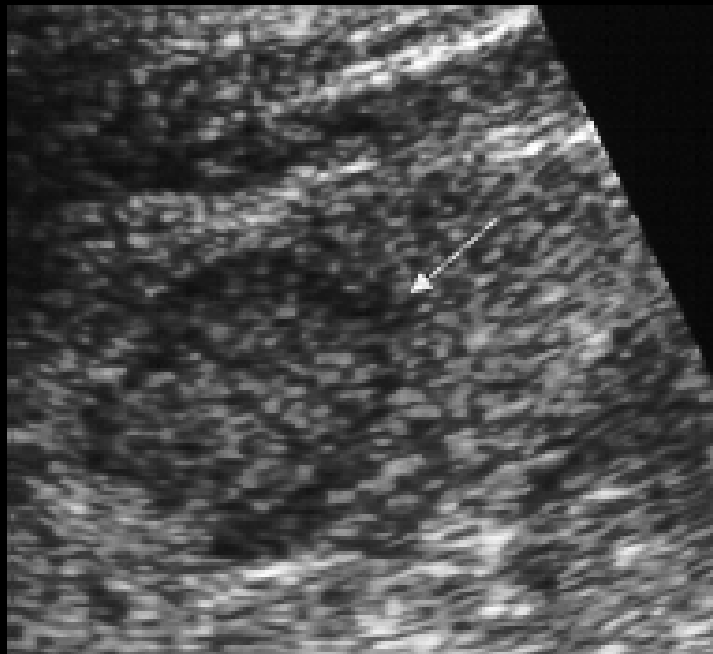
Søren R. Rafaelsen MD
Danish Colorectal Cancer Group South
Institute of Regional Health Services Research
University of Southern Denmark
Departments of Radiology
Vejle Hospital
Kabbeltoft 25
DK-7100 Vejle Denmark

Colorectal Disease 2010

“Accepted Article”

DOI: 10.1111/j.1463-1318.2010.02288.x

Liver mets from colorectal cancer



Detection of Liver Mets in 295 Patients

Sensitivity:



- Ultrasound (without CEUS) 70 %
- IOUS 97 %

Rafaelsen SR, Kronborg O, Larsen C, Fenger C.

Intraoperative ultrasonography in detection of hepatic metastases from colorectal cancer.

Dis Colon Rectum 1995;38:355-360.



AIM

- To compare the sensitivity and specificity of CEUS and MDCT in the detection of synchronous liver metastases in patients with colorectal cancer
- To use CEUS to evaluate the time from injection to arrival in the hepatic vein (ATHV).



CEUS



- Non-CEUS US using a 5 MHz transducer
Acuson Sequoia 512
- CEUS was performed after a bolus injection of 2.4 ml SonoVue followed by 10 ml NaCl injected into the cubital vein
- Low mechanical index ($MI = 0.11$) using CPS software
- The interval from injection to arrival time in the hepatic vein (ATHV) was noted.
- Experienced radiologists

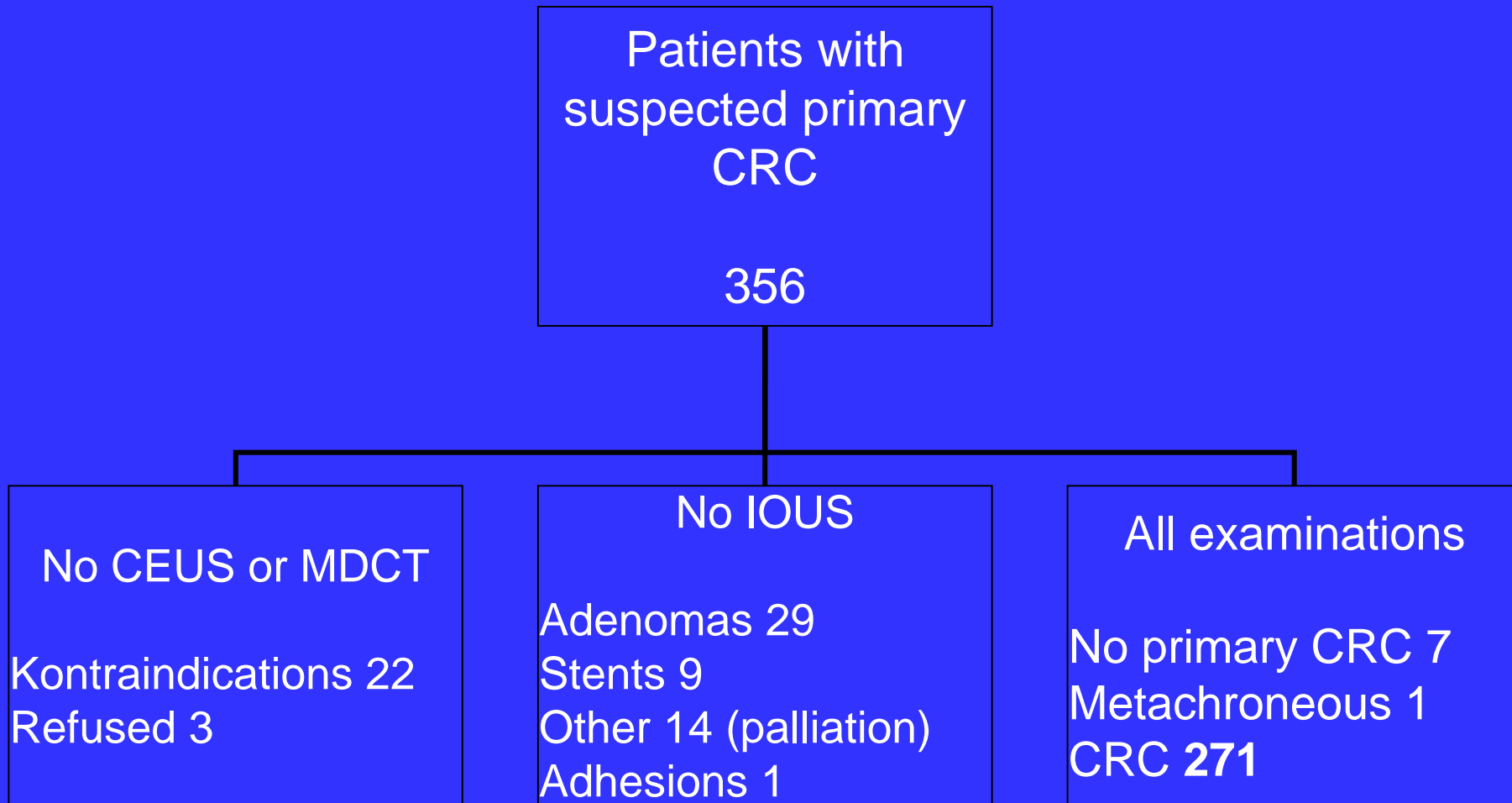


MDCT



- CT scans were performed with a 64-slice CT system
- The effective dose: 8-9 mSv
- Images were obtained after IV injection of 100 ml Iomeron 300 mg I/ml using an automatic injector at an inj. rate of 4 ml/sec
- Contrast-enhanced CT scanning in the portal phase
- An additional arterial phase was performed until June 2006 using a Somatom Sensation 4 MDCT scanner
- CT images were interpreted by 2 radiologists blinded to CEUS

Flowchart



September 2004 to December 2008

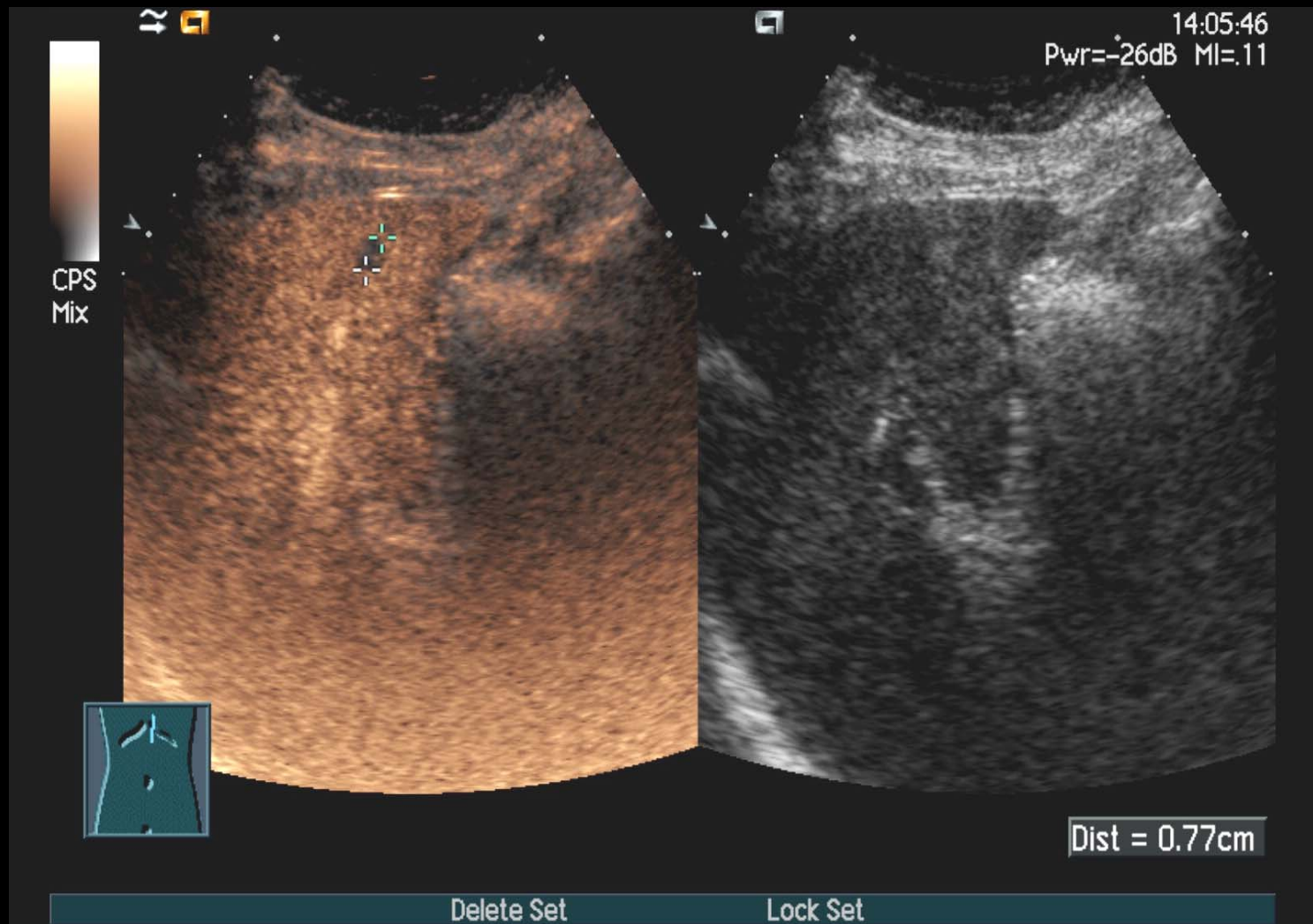


Gold standard

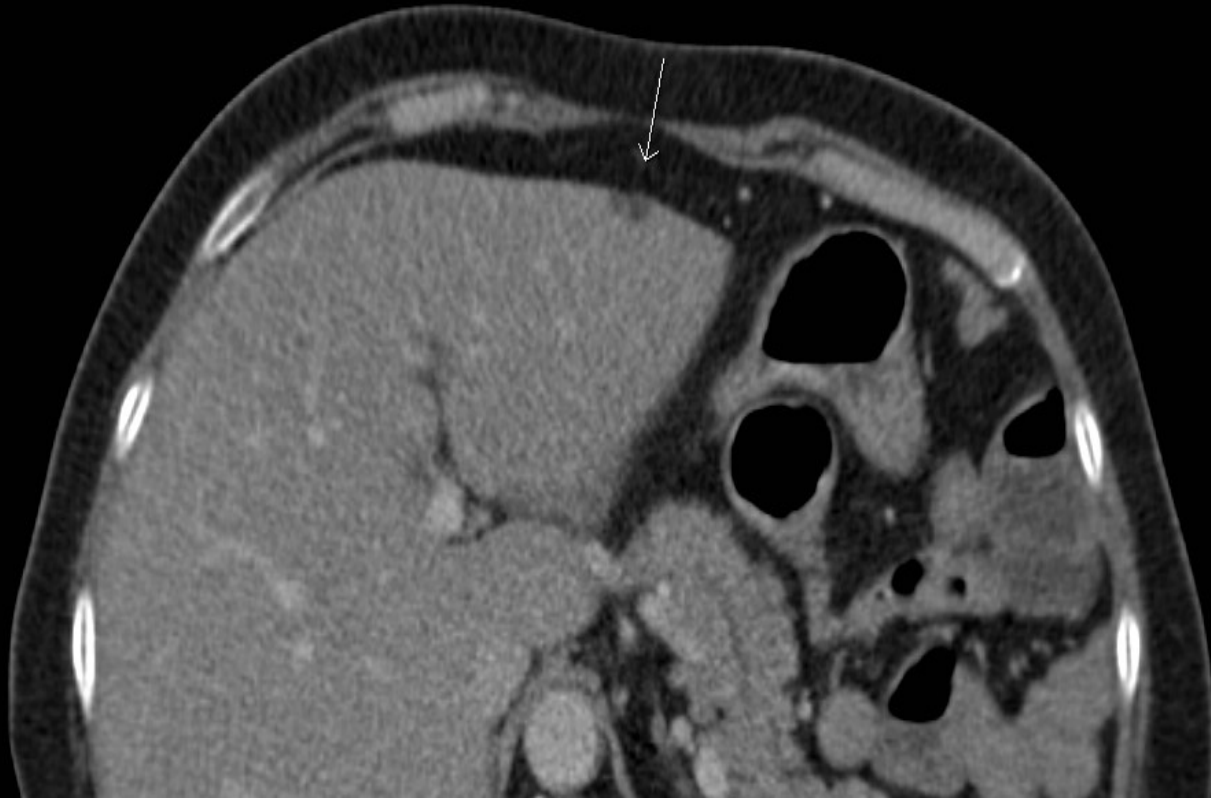
- Intraoperative ultrasound (Hitachi, EUB-650) of the liver was used as gold standard in all 271 patients.
- Additional **follow-up**, dynamic contrast enhanced **MRI**, **PET/CT** or ultrasound guided **biopsy** was performed on all suspicious lesions or if there was any inconsistency in the results.
- When liver resection was performed, the pathological examination contributed to the gold standard.
- Any new metastases detected after three months after CEUS and CT were not considered synchronous liver metastases.
- When all modalities showed a benign lesion, the lesion was considered true negative in regard of hepatic metastases.

Data

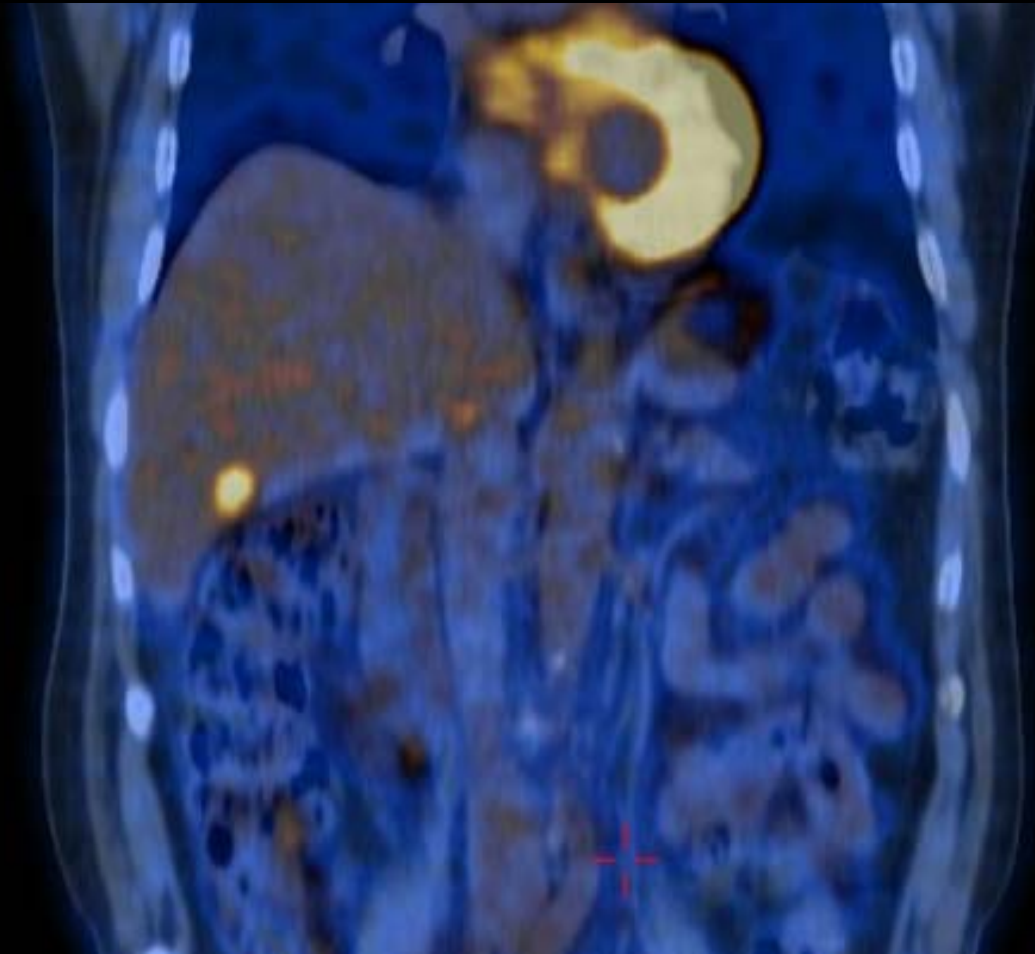
- Data were analyzed using descriptive statistics and proportions were compared by **Fisher's exact test**.
- Difference in medians was assessed by the **unpaired Mann-Whitney test**.
- All patients signed the informed consent form.



- Liver met detected by CEUS



A 68 year old female with one 10 mm liver met . CEUS failed detection.
The finding was confirmed by IOUS.



A 70 year old male with hepatic metastasis detected by IOUS and PET/CT. Preoperative CEUS and MDCT were negative.

	CEUS	MDCT
Sensitivity	85.7% (62.6 – 96.2%)	85.7% (62.6 – 96.2%)
Specificity	97.6% (94.6 – 99.0%)	95.6% (92.0 – 97.7%)
Positive predictive value	75.0% (52.9 – 89.4%)	62.1% (42.4 – 78.7%)
Negative predictive value	98.8% (96.2 – 99.7%)	98.8% (96.1 – 99.7%)

The sensitivity of combined CEUS and MDCT was 90.1% (95% CI: 68.2 – 98.3%)

Liver Mets CRC: Sensitivity

Author	N (Met %)	CEUS	MDCT
Piscaglia 2007	92 (60%)	96 %	91 %
Larsen 2009	274 (14%)	80%	89 %
Cantisani 2010	110 (64%)	96%	97 %
Rafaelsen 2010	271 (8%)	86 %	86 %

6 FP CEUS

- 4 of these were cysts confirmed by either, IOUS, CT or follow-up.
- 2 false positives were haemangiomas confirmed by dynamic MRI and negative PET/CT.

11 FP at MDCT

- 6 cysts confirmed by IOUS and follow-up.
- 3 had a haemangioma confirmed by dynamic MRI and negative PET/CT.
- 2 false positives on MDCT showed no abnormalities with CEUS, IOUS and follow-up

CEUS - ATHV

- Patients without liver mets had a median ATHV: **22 sec.**(IQR: 20 – 25 sec.)

$P < 0.05$

- Patients with liver mets had a median ATHV: **18 sec.** (IQR: 15 – 21 sec.)

- Patients with more than 5 liver mets ATHV: **16 sec.**(IQR: 11 – 18 sec.)

Strength and Limitation

- Prospective and blinded
- State of the art CEUS and CT same day
- No patient was excluded because of extreme obesity or steatosis of the liver
- All patients had IOUS
- Uniform population
- The low number of patients with liver mets
- The standard reference of IOUS could probably have been improved by mobilizing the liver prior to scanning
- No use of CEUS - IOUS

Conclusion

- CEUS showed sensitivity and specificity comparable to that of MDCT
- Higher PPV of CEUS
- ATHV was shorter in the metastatic group than in patients without liver metastases.



Acknowledgements

- Anders Jakobsen MD DMSc
- Lone Østergaard MD
- Torben Sørensen MD
- Chris Vagn-Hansen MD
- Jens Christian Riis Jørgensen MD
- Claus Bisgaard MD
- Mette Klante and Karin Larsen for secretarial assistance.
- Else Ibsen (Booking)
- Hanne Watts
- Jacob v. B. Hjelmborg



SJRS 2010

